Spot Safety Project Evaluation

Project Log # 200712077

Spot Safety Project # 08-01-208

Spot Safety Project Evaluation of the "Vehicle Entering" Flasher
At the Intersection of US 421 and SR 1529 (Cox Mill Rd)
Lee County

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

Principal Investigator

_____ _____
Jason B. Schronce Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 08-01-208 – The Intersection of US 421 and SR 1529 (Cox Mill Rd) in Lee County near the City of Sanford.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of "Vehicle Entering" flashers. US 421 and SR 1529 (Cox Mill Rd) are both two-lane, two-way facilities at the subject intersection with right turn auxiliary lanes on the US-421 approaches. The speed limits are 55 mph for all approaches to the intersection. The subject location is a crossroads type intersection, which is controlled by dual posted stop signs on SR 1529 with concrete channelization medians.

The full countermeasure included installing actuated "Vehicle Entering" flashers and an enlarged outside stop sign with a continuous red flasher atop of the SR 1529 approaches along with an overhead continuous yellow flasher for the US 421 approaches. The original statement of problem was the developing angle crash pattern of vehicles either entering or attempting to cross US 421.

The initial crash analysis was completed from December 31, 1997 to December 31, 2000 with seventeen (17) reported crashes, twelve (12) of which were Angle Crashes. The final completion date for the improvement at the subject intersection was on July 31, 2002 with a total cost of $17,500.00.

Naive Before and After Analysis

After reviewing the spot safety project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from July through August 2002. The before period consisted of reported crashes from May 1, 1997 through June 30, 2002 (5 years and 2 months); and the after period consisted of reported crashes from September 1, 2002 through October 31, 2007 (5 years and 2 months). The ending date for this analysis was determined by the date of available crash data at the time of analysis.

The treatment data consisted of all crashes within 150 feet of the subject intersection. *Please see attached location map and photos for further details.*

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Frontal Impact Crashes were the target crashes for the applied countermeasure. The Frontal Impact Crash types considered are as follows: Left turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; and Angle.

Treatment Information			
	Before	**After**	**Percent Reduction (-) Percent Increase (+)**
Total crashes	24	17	- 29.17 %
Total Severity Index	5.93	8.94	50.76 %
Target Crashes	18	11	- 38.89 %
Target Crash Severity Index	6.34	11.93	88.17 %
Volume	13,400	12,100	- 9.70 %
Injury Crash Summary			
Fatal injury Crashes	0	1	100.00 %
Class A injury Crashes	0	0	N/A
Class B injury Crashes	7	0	- 100.00 %
Class C Injury Crashes	9	8	- 11.11 %
Total Injury Crashes	16	9	- 43.75 %

The naive before and after analysis at the treatment location resulted in a 29 percent decrease in Total Crashes, a 39 percent decrease in Target Crashes, and a 51 percent increase in the Total Severity Index. The before period ADT year was 1999 and the after period ADT year was 2005.

Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 29 percent decrease in Total Crashes and an 39 percent decrease in Target Crashes. The summary results above demonstrate that both Total Crashes and Target Crashes appear to have decreased at the treatment location from the before to the after period.

Referencing the *Collision Diagrams*, the dominating crash pattern at the intersection in the study period were angle collisions, which reduced from 18 to 10 from the before to the after period. However, one after period angle crash did result in a fatality which based off severity gives the overall intersection a negative benefit-cost ratio. Rear-end crashes remained consistent from the before to the after period.

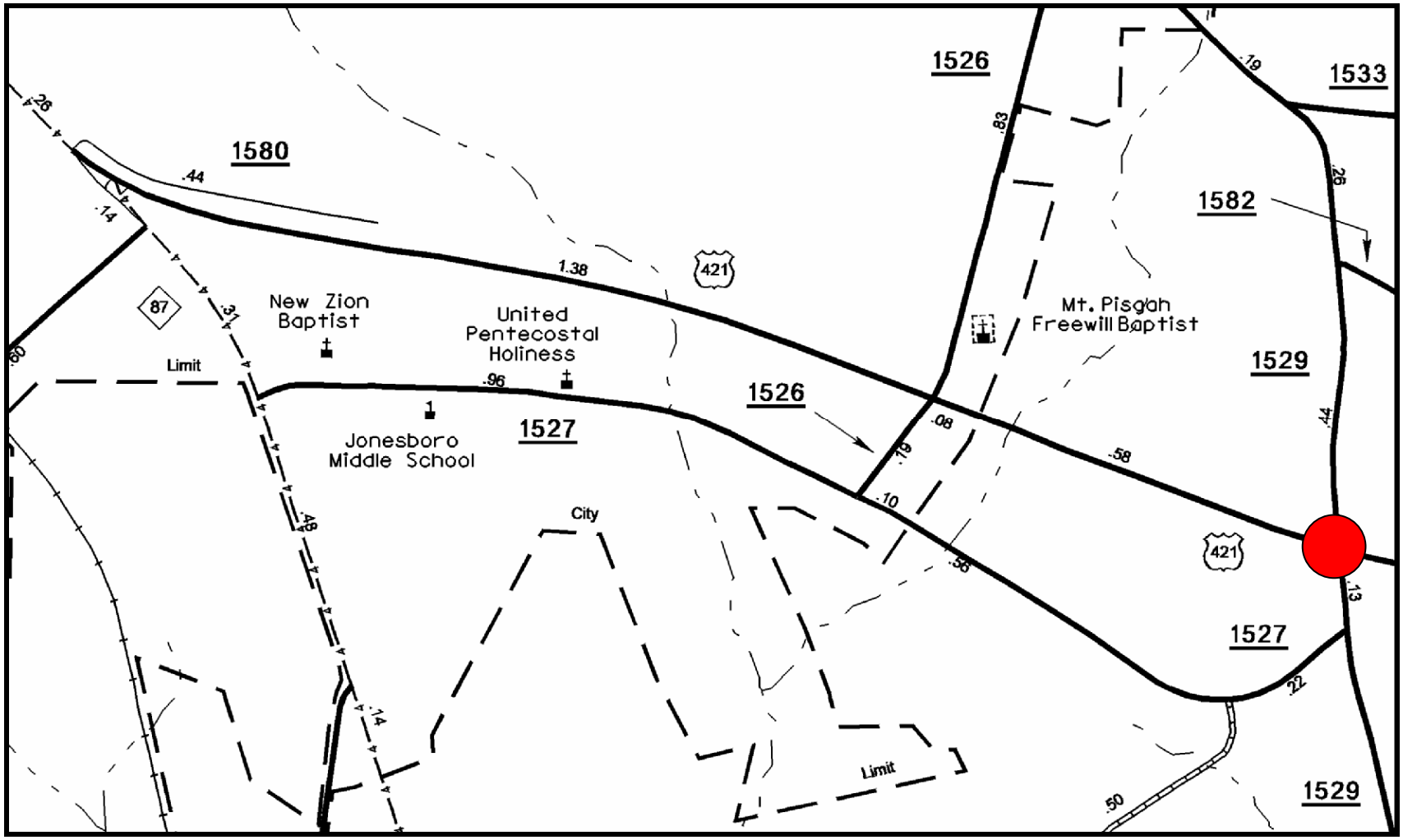
As a result from the after period fatal investigation, it was determined that the age of the at-fault driver was 15 with no driver's license. No significant roadway changes were suggested but vegetation was trimmed around the eastbound US 421 intersection warning sign and along the westbound shoulder to help improve sight distance.

The calculated benefit to cost ratio for this project is -17.40 considering total crashes. The benefit to cost ratio considering only target crashes is -18.09. The benefits are calculated using the change in annual crash costs from the before to the after period. Operational and other benefits related to the project are not considered in this analysis. The costs of the project include the actual construction costs as well as the increase in annual maintenance and utility costs.

Please see the attached *Treatment Site Photos*. Photos are provided for all approaches to the treatment intersection. Also note that during our field investigation on March 26, 2008 continuous shoulder rumble strips were observed on SR 1529. This countermeasure does not affect the current evaluation and the crash patterns analyzed within this study.

As the Safety Evaluation Group completes additional spot safety reviews for this type of countermeasure, we will be able to provide objective and definite information regarding actual crash reduction factors for this type of intersection.

Location Map
Lee County, near Sanford
Evaluation of Spot Safety Project # 08-01-208



Treatment Location: US 421 at SR 1529 (Cox Mill Road)

SS# 08-01-208 Aerial Map

TREATMENT SITE PHOTOS TAKEN 3/26/2008

Traveling East on US 421

Traveling North on SR 1529 (Cox Mill Rd)

Traveling North on SR 1529 (Cox Mill Rd) – Turn stop sign posted flasher

Traveling South on SR 1529 (Cox Mill Road)

Traveling West on US 421

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 421 at SR 1529 | BY: JBS
COUNTY: Lee | DATE: 3/31/2008
FILE NO.: SS 08-01-208 | NOTES: Total Crashes

DETAILED COST: TYPE IMPROVEMENT - Vehicle Entering When Flashing

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$17,500	10	0.149	$2,608
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$17,500	10	0.149	$2,608

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $1,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $350

TOTAL ANNUAL COST= $3,958
TOTAL COST OF PROJECT= $17,500

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	5.17	0	0.00	16	3.09	8	1.55	$61,741
AFTER	5.17	1	0.19	8	1.55	8	1.55	$130,600

Annual Benefits from Crash Cost Savings ($68,859)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($72,817)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -17.40

TOTAL COST OF PROJECT - $17,500 **COMPREHENSIVE B/C RATIO - -17.40**

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 421 at SR 1529 | BY: JBS
COUNTY: Lee | DATE: 3/31/2008
FILE NO.: SS 08-01-208 | NOTES: Target Crashes - Frontal Impact

DETAILED COST: TYPE IMPROVEMENT - Vehicle Entering When Flashing

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$17,500	10	0.149	$2,608
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$17,500	10	0.149	$2,608

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $1,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $350

TOTAL ANNUAL COST= $3,958
TOTAL COST OF PROJECT= $17,500

COMPREHENSIVE COST REDUCTION:

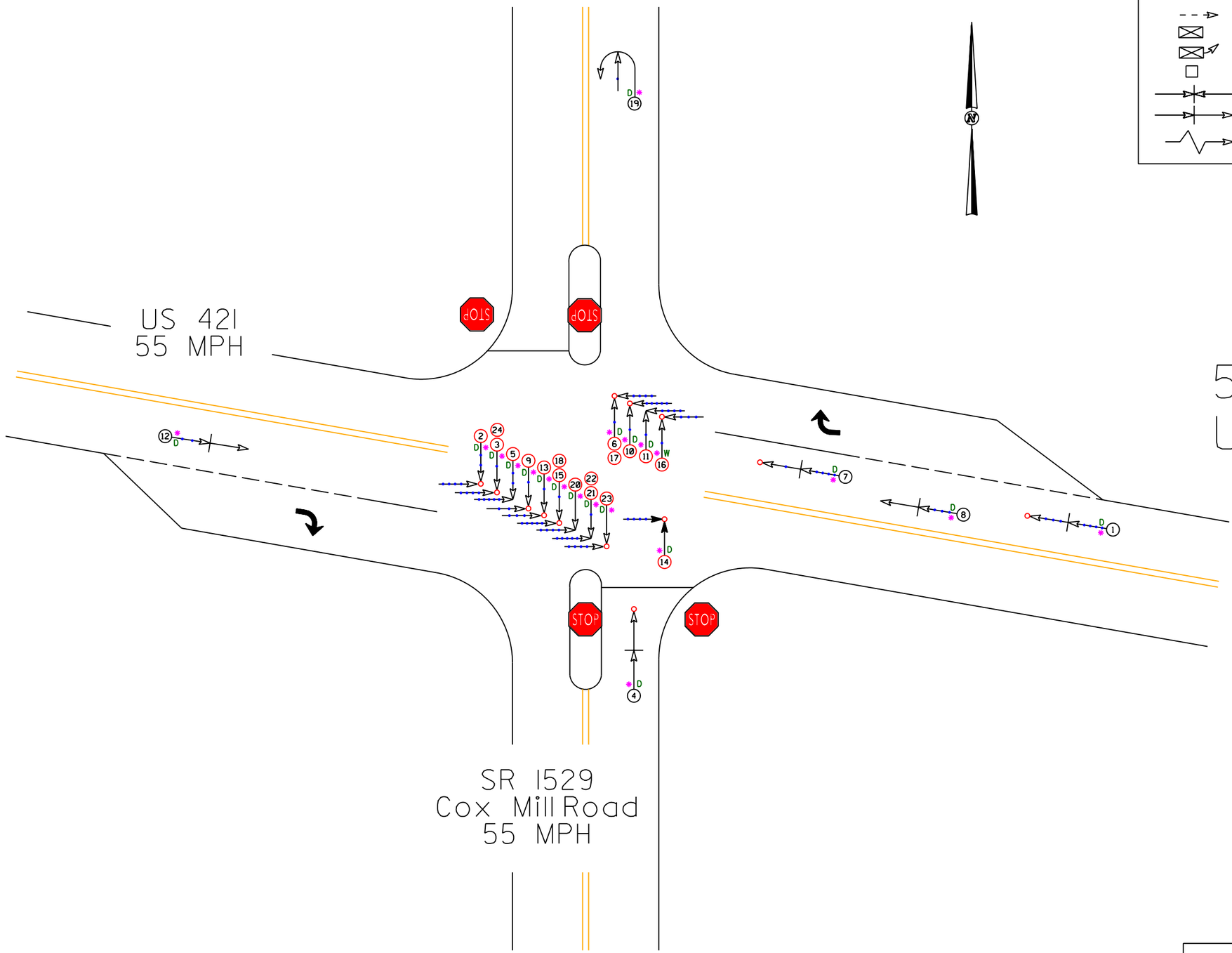
		ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES						
TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	5.17	0	0.00	13	2.51	5	0.97	$49,033
AFTER	5.17	1	0.19	6	1.16	4	0.77	$120,619

Annual Benefits from Crash Cost Savings ($71,586)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($75,544)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -18.09

TOTAL COST OF PROJECT - $17,500 COMPREHENSIVE B/C RATIO - -18.09



LEGEND

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
FIXED OBJECT
HEAD ON
REAR END
RAN OFF ROAD

ANGLE
TURNING
BACKING
SIDESWIPE
OUT OF CONTROL
INJURY
FATALITY

9 MPH OR LESS
10 MPH TO 19
20 MPH TO 29
30 MPH TO 39
40 MPH TO 49
50 MPH TO 59
60 MPH TO 69
70 AND UP
SPEED UNKNOWN

P PEDESTRIAN
T TRAIN
* DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY
O OILY

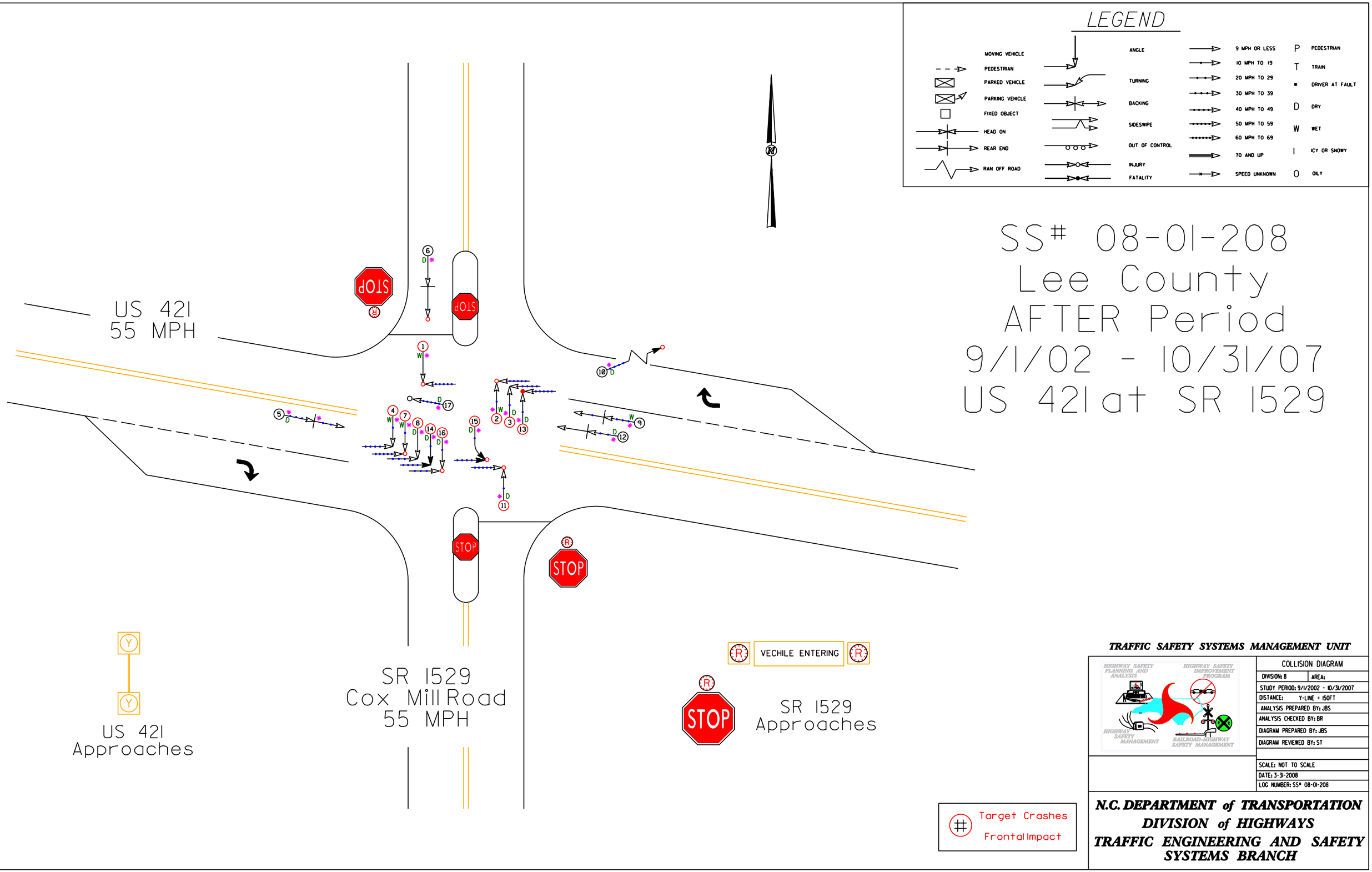
SS# 08-01-208
Lee County
BEFORE Period
5/1/97 - 6/30/02
US 421 at SR 1529

Target Crashes
Frontal Impact

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

COLLISION DIAGRAM	
DIVISION: 8	AREA:
STUDY PERIOD: 5/1/1997 - 6/30/2002	
DISTANCE: Y-LINE = 150FT	
ANALYSIS PREPARED BY: JBS	
ANALYSIS CHECKED BY: BR	
DIAGRAM PREPARED BY: JBS	
DIAGRAM REVIEWED BY: ST	
SCALE: NOT TO SCALE	
DATE: 3-31-2008	
LOG NUMBER: SS# 08-01-208	

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH



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